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Mechanical Analysis of W78/88-1 Life Extension Program Warhead Design Options

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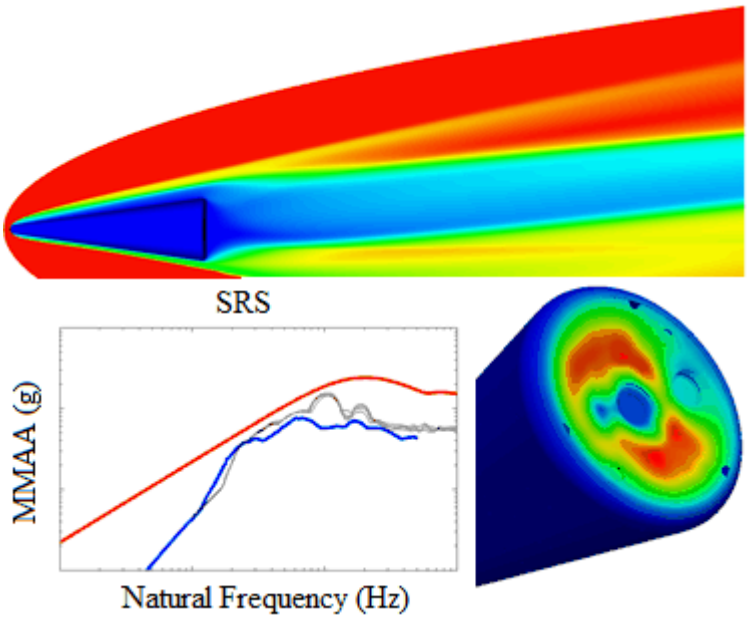
Life Extension Program (LEP) is a program to repair/replace components of nuclear weapons to ensure the ability to meet military requirements. The W78/88-1 LEP encompasses the modernization of two major nuclear weapon reentry systems into an interoperable warhead. Several design concepts exist to provide different options for robust safety and security themes, maximum non-nuclear commonality, and cost. Simulation is one capability used to evaluate the mechanical performance of the designs in various operational environments, plan for system and component qualification efforts, and provide insight into the survivability of the warhead in environments that are not currently testable. The simulation efforts use several Sandia-developed tools through the Advanced Simulation and Computing program, including Cubit for mesh generation, the DART Model Manager, SIERRA codes running on the HPC TLCC2 platforms, DAKOTA, and ParaView. Several programmatic objectives were met using the simulation capability including: (1) providing early environmental specification estimates that may be used by component designers to understand the severity of the loads their components will need to survive, (2) providing guidance for load levels and configurations for subassembly tests intended to represent operational environments, and (3) recommending design options including modified geometry and material properties. These objectives were accomplished through regular interactions with component, system, and test engineers while using the laboratory's computational infrastructure to effectively perform ensembles of simulations.

Because NNSA has decided to defer the LEP program, simulation results are being documented and models are being archived for future reference. However, some advanced and exploratory efforts will continue to mature key technologies, using the results from these and ongoing simulations for design insights, test planning, and model validation.



Flight and radiation environment contour plots are shown along with a calculated shock response spectrum used for environmental specifications.